

Remarks

Applicants respectfully request that the Examiner reconsider the present application in light of the above amendments and following remarks. Claims 1, 3, 6-8 and 10 have been amended and claims 2 and 9 have been cancelled. No claims have been added. Therefore, claims 1, 3-8 and 10-16 are pending in the present application.

Claims 1, 3 and 4 have been rejected under 35 U.S.C. § 102(a) as being anticipated by U.S. Patent No. 6,313,726 to Golovatai-Schmidt et al. ("the Golovatai reference"). Applicants respectfully traverse this rejection.

Amended claim 1 is directed to a solenoid for providing linear actuation having first and second polepieces with axial bores that are coaxially disposed along a common axis, an electrical conductor wound about the polepieces in a plurality of turns, and an armature movably disposed in the axial bores. In addition, a bearing is axially retained in one of said first and second polepieces and operates to radially support a shaft. The shaft is attached coaxially to the armature and extends through a supportive bore in the bearing. The shaft is axially displaceable by electromagnetic displacement of the armature to provide the actuation. Further, the armature is entirely separated from the axial bore of the polepieces by a generally cylindrical air gap.

By providing a solenoid in accordance with the present invention, numerous advantages are realized. For instance, removing the sleeve used in prior art solenoid actuators allows the actuator to be entirely separated from the first and second polepieces, which results in improved performance of the solenoid in the present invention. See FIG. 3.

None of the references of record teach or suggest a solenoid having an armature that is entirely separated from the axial bores of the first and second polepieces by a generally cylindrical air gap as recited in amended claim 1. While the Golovatai reference may include a gap (7) between the armature (8) and the coil spool (2), there is no gap formed between armature (8) and polepiece (22) as required by claim 1. Instead, as best seen in FIG. 2 of the Golovatai reference, the bottom portion of armature (8) is in contact with the polepiece (22). The contact between the armature (8) and the polepiece (22) will create a drag force on the shaft during linear actuation, which highlights one of the problems the present invention intends to solve.

For at least the forgoing reasons, Applicants respectfully request that the rejection of claim 1 be withdrawn. As claims 3 and 4 depend from claim 1, these claims are also not taught or suggested by the references of record for the same reasons set forth with respect to claim 1. Thus, Applicants request that the rejection of claims 3 and 4 also be withdrawn.

Dependant claims 3 and 4 include additional features that further distinguish the present invention from the references of record. For instance, amended claim 3 is directed to the solenoid recited in claim 1 with an armature that is frusto-conical, wherein the armature is prevented from contacting the polepieces. See *Specification*, pg. 5, lines 18-20. Since the armature in the Golovatai reference is not prevented from contacting the polepieces, the Golovatai reference fails to teach every limitation included in claim 3. While the armature in the Golovatai reference may be cylindrical with one of its distal ends being tapered inwardly, the armature is not frusto-conical as suggested by the Examiner. See *Office Action*, pg. 2. For this additional reason, Applicants request that the rejection of claim 3 be withdrawn.

Claim 5 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over the Golovatai reference. As stated above, the Golovatai reference does not teach or suggest a solenoid having an armature that is entirely separated from the axial bores of the first and second polepieces by a generally cylindrical air gap as recited in amended claim 1. As claim 5 depends from claim 1 and includes all of the limitations therein, claim 5 is not taught or suggested by the references of record for at least the same reasons set forth with respect to claim 1. Thus, Applicants request that the rejection of claim 5 be withdrawn.

Claims 6-8 and 10-16 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over the Golovatai reference in view of U.S. Patent No. 5,947,092 to

Hussey et al. ("the Hussey reference"). Applicants respectfully traverse this rejection.

As with claim 1, claims 6, 7 and 8 are directed to a solenoid having an armature that is entirely separated from the axial bores of the first and second polepieces by a generally cylindrical air gap. Therefore, Applicants submit that claims 6, 7 and 8 are also not taught or suggested by the Golovatai reference for at least the same reasons set forth with respect to claim 1. Moreover, the Hussey reference fails to add anything to the Golovatai reference except to provide an actuation valve having a sleeve (112) positioned between an armature (110) and a pair of polepieces (60, 62). See Col. 5, lines 45-62. Not only does the Hussey reference fail to provide for an air gap as required by the present invention, the sleeve in the Hussey reference contributes to the thickness of the non-magnetic gap between the armature and the polepieces thereby limiting the maximum actuating force of the solenoid. See *Specification*, pg. 2, lines 8-13; FIG. 1. Therefore, the Hussey reference actually highlights the prior art drawbacks and deficiencies that the present invention intends to solve.

Since claims 10-12 depend from claim 8 either directly or indirectly, these claims are also allowable over the Golovatai reference for at least the same reasons discussed above with respect to claim 1. Moreover, claim 10 is believed to distinguishable over the references of record since there is no teaching or

suggestion of a frusto-conical armature that is prevented from contacting the polepieces.

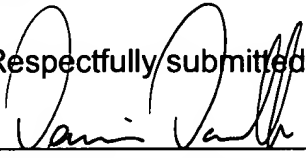
Claims 13-16 are also not taught or suggested by the references of record. Claims 13-16 depend from claims 1, 6, 7 and 8, respectively, and are directed to a solenoid having a bearing with an axial length that is 1.5 times larger than the diameter of the shaft. In rejecting claims 13-16, the Examiner generally stated that "[a]ll of the structural limitations of the valve have been met." *Office Action*, pg. 3. However, the Examiner has failed to point out any specific features in the Golovatai and Hussey references that disclose a bearing, as disclosed in independent claims 1, 6, 7 and 8, having an axial length that is 1.5 times larger than the diameter of the shaft. See *Ex parte Humpherys*, 24 USPQ.2d 1255 (B.P.A.I. 1992) (stating that the Examiner must provide specific reasons to support an obviousness rejection). Given the failure to point out anything in the references of record to teach the features included in claims 13-16, Applicants request that the rejection of claims 13-16 be withdrawn.

Conclusion

Accordingly, Applicants submit that claims 1, 3-8 and 10-16 are in condition for allowance and such allowance is respectfully requested. Should the Examiner feel that any unresolved issues remain in this case, the undersigned may be contacted at the telephone number listed below to arrange for an issue resolving conference.

Applicants do not believe that any fees are due at this time, however, the Commissioner is hereby authorized to charge any fees that may have been overlooked to Deposit Account No. 10-0223.

4/12/04
Date

Respectfully submitted,


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